

What is claimed is:

1. An apparatus comprising:
an electrical lead comprising a lead body and an electrical conductor; and
5 an electrode coupled to the electrical conductor, wherein the electrode includes a coating on at least a portion of a surface of the electrode, the coating including two or more layers, with a first layer adjacent the surface of the electrode including an insulative material and a second layer adjacent the first layer including at least one pharmacological agent.

10 2. The apparatus of claim 1, wherein the electrode includes a helical tip.

3. The apparatus of claim 1, wherein the pharmacological agent comprises an anti-arrhythmic agent, an angiogenic growth factor, an anti-inflammatory agent, an
15 anti-proliferative agent, or a combination thereof.

4. The apparatus of claim 3, wherein the anti-inflammatory agent is dexamethasone, clobetasol, beclomethasone, or a pharmaceutically acceptable salt thereof.

20 5. The apparatus of claim 1, wherein the first layer comprises a polymeric base coat on the electrode surface and the second layer comprises a matrix including a polymer and at least one pharmacological agent, wherein the second layer at least partially covers the polymeric base coat.

25 6. The apparatus of claim 5, wherein the pharmacological agent comprises an anti-arrhythmic agent, an angiogenic growth factor, an anti-inflammatory agent, an anti-proliferative agent, or a combination thereof.

7. The apparatus of claim 6, wherein the anti-inflammatory agent is dexamethasone, clobetasol, beclomethasone, or a pharmaceutically acceptable salt thereof.

5 8. The apparatus of claim 5, wherein the polymeric base coat is ethylene vinyl alcohol.

9. The apparatus of claim 1, further comprising a third layer above the second layer, wherein the third layer includes a porous barrier.

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10. The apparatus of claim 9, wherein the porous barrier comprises a polymeric coating.

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11. The apparatus of claim 9, wherein the third layer regulates the release of the pharmacological agent from the matrix.

12. The apparatus of claim 1, further comprising an outer layer, wherein the outer layer includes at least one pharmacological agent.

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13. The apparatus of claim 12, wherein the pharmacological agent comprises an anti-arrhythmic agent, an angiogenic growth factor, an anti-inflammatory agent, an anti-proliferative agent, or a combination thereof.

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14. The apparatus of claim 13, wherein the anti-inflammatory agent is dexamethasone, clobetasol, beclomethasone, or a pharmaceutically acceptable salt thereof.

15. The apparatus of claim 1, wherein the first layer is adapted to functionally increase an impedance of the electrode.

16. A system comprising:

- 5 an electrical pulse generator;
an electrical lead releasably coupled to electrical pulse generator, wherein the electrical lead includes a lead body and an electrical conductor; and
an electrode coupled to the electrical conductor, wherein an outer surface of the electrode is coated with two or more layers comprising an insulative material
10 and at least one pharmacological agent.

17. The system of claim 16, wherein the electrode includes a helical tip.

18. The system of claim 16, wherein the pharmacological agent comprises an
15 anti-arrhythmic agent, an angiogenic growth factor, an anti-inflammatory agent, an anti-proliferative agent, or a combination thereof.

19. The system of claim 18, wherein the anti-inflammatory agent is dexamethasone, clobetasol, beclomethasone, or a pharmaceutically acceptable salt
20 thereof.

20. The system of claim 18, wherein the anti-inflammatory agent is dexamethasone.

25 21. The system of claim 16, wherein the two or more layers comprise a first layer and a second layer, wherein the first layer comprises a polymeric base coat on the electrode surface and the second layer comprises a polymer and at least one pharmacological agent matrix on the polymeric base coat.

22. The system of claim 21, wherein the pharmacological agent comprises an anti-arrhythmic agent, an angiogenic growth factor, an anti-inflammatory agent, an anti-proliferative agent, or a combination thereof.

5 23. The system of claim 22, wherein the anti-inflammatory agent is dexamethasone, clobetasol, beclomethasone, or a pharmaceutically acceptable salt thereof.

10 24. The system of claim 21, wherein the polymeric base coat is ethylene vinyl alcohol.

25. The system of claim 21, further comprising a third layer, wherein the third layer comprises a porous barrier.

15 26. The system of claim 25, wherein the third layer regulates the release of the pharmacological agent from the matrix.

20 27. The system of claim 25, further comprising a fourth layer, wherein the fourth layer comprises at least one pharmacological agent.

28. The system of claim 27, wherein the pharmacological agent of the fourth layer comprises an anti-arrhythmic agent, an angiogenic growth factor, an anti-inflammatory agent, an anti-proliferative agent, or a combination thereof.

25 29. The system of claim 28, wherein the anti-inflammatory agent is dexamethasone, clobetasol, beclomethasone, or a pharmaceutically acceptable salt thereof.

30. An apparatus comprising:
an electrical lead comprising a lead body and an electrical conductor; and
an electrode coupled to the electrical conductor, wherein the electrode
includes a coating on at least a portion of a surface of the electrode, the coating
5 including two or more layers, with an inner layer including a pharmacological agent
in a polymer matrix for regulated, chronic release of the pharmacological agent and
an outer layer including only a pharmaceutical agent such that the pharmaceutical
agent of the outer layer is exposed to tissue upon implant of the electrode.

10 31. The apparatus of claim 30, wherein the electrode includes a helix.

32. The apparatus of claim 30, further including a third layer directly adjacent a
surface of the electrode comprising a polymer primer layer, with the inner layer
adjacent the polymer primer layer.

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33. The apparatus of claim 30, wherein the pharmaceutical agent in the polymer
matrix includes an anti-inflammatory drug.

20 34. The apparatus of claim 30, wherein the pharmaceutical agent in the polymer
matrix includes an anti-proliferative drug.

35. A method comprising:
coating an electrode with a first layer, wherein the first layer comprises a
polymeric base coat; and

25 coating the electrode with a second layer, wherein the second layer
comprises a polymer and at least one pharmacological agent, and at least partially
coats the first layer.

36. The method of claim 35, wherein the pharmacological agent comprises an anti-arrhythmic agent, an angiogenic growth factor, an anti-inflammatory agent, an anti-proliferative agent, or a combination thereof.

5 37. The method of claim 36, wherein the anti-inflammatory agent is dexamethasone, clobetasol, beclomethasone, or a pharmaceutically acceptable salt thereof.

10 38. The method of claim 35, wherein the polymeric base coat is ethylene vinyl alcohol.

39. The method of claim 35, further comprising a third layer, wherein the third layer comprises a porous barrier.

15 40. The method of claim 39, wherein the third layer regulates the release of the pharmacological agent from the matrix.

41. The method of claim 35, further comprising an outer layer, wherein the outer layer comprises at least one pharmacological agent.

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42. The method of claim 41, wherein the pharmacological agent comprises an anti-arrhythmic agent, an angiogenic growth factor, an anti-inflammatory agent, an anti-proliferative agent, or a combination thereof.

25 43. The method of claim 42, wherein the anti-inflammatory agent is dexamethasone, clobetasol, beclomethasone, or a pharmaceutically acceptable salt thereof.

44. The method of claim 35, wherein the coating is applied by contacting the exterior of the helix with a composition comprising at least one polymer and at least one pharmacological agent.

5 45. The method of claim 44, wherein the contacting includes spraying.